



# Utilization of *Acacia seyal*(*Talih*) bark powder Extract for Manufacture of Upper leather as Alternative Retanning Agent

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## Abstract

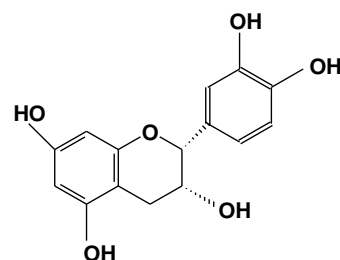
This study was conducted at Alfula area which located at longitude 20-28 south and latitude 11-43 north the over all objective of this study were to fill the looser and softer parts of leather in order to produce leathers of more uniform physical properties. This is to investigate that the process will allow for the production of unlined footwear, to improve on the chemical stability of the leather, prompt rapid finishing and delivery to the customer. The plant has been evaluated and reported for application in the retanning of the leather. The process involves extracting the barks of *Acacia seyal* (*Talih*) for 1 hour with distilled water (1:10 w/v) at temperature above 80°C. The *Talih* extract once was applied during prepared the retanning of wet blue leathers. To determine The efficacy of the pontency and effectiveness of the *Acacia seyal* (*Talih*) and extract during the retanning of wet blue leathers when the control and experimental retannage methodologies was applied was determined. The result of *Acacia seyal* (*Talih*) retanned compared to *Acacia pycnantha*(Wattle) retanned leathers. *Acacia seyal* (*Talih*) showed good grain tightness and retanned leathers were found to be better than *Acacia pycnantha*(Wattle) retanned. Further analysis of physical characteristic tests indicated that it can be used as an alternative retanning material.

**Keywords-Index Terms -;** *Chrome leather, Upper leather Retannage; Acacia seyal (Talih)*

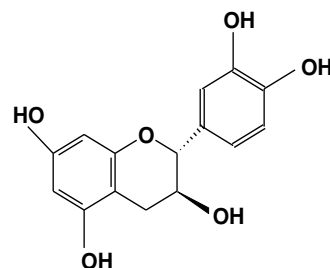
## Introduction

The term 'post tanning' refer to the wet processing steps that follow the primary tanning reaction. This might refer to processing stage after the leather tannage with chromium (III), commonly applied in the leather industry. However, this term can be applied, to vegetable tanning or indeed any other tannage used to re- confer the primary stabilization to the pelt. In all cases, post tanning can be separated into three generic processes: retanning, dyeing and fatliquoring (Covington, 2009). Retanning may be a single chemical process or may be a combination of reactions applied together or more usually consecutively. The purpose is to modify and enhance the properties and performance of the ultimate leather physical properties. These changes include the handle, the chemical and hydrothermal stability or the appearance of the leather. The effects are dependent on both the primary tanning chemistry and the retanning reactions (Covington, 2009).

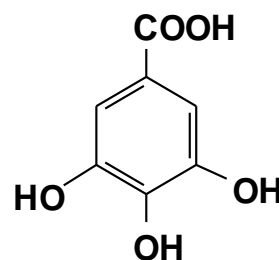
Vegetable tannins materials are widely employed for retanning side leather and they are occasionally used in calf and goatskin in upper leather productions. They are also widely employed as general mordants for the production of dry crust tanned chrome leathers. They are cheap, readily available, good filling agents, and make the grain hydrophilic. While the condensed tannins, such as mimosa or quebracho, reduce the chrome characteristics only slightly but impart leathers with poor fastness. The most widely condensed tannins are based on (-)- epicatechin (Fig. 1) and (+) - catechin (Fig. 2) (Hagerman and Johnson,1997).. However, the condensed tannins, the hydrolyzable tannins, such as sumach, myrabolans, or chestnut, give leather of improved light fastness and soft mellow handle [Tuck,1981]. Hydrolysable tannins contain gallic acid (Fig. 3) esterified with glucose (Hagerman and Johnson,1997).



(Figure1) Epicatechin



(Figure2) Catechin



(Figure3) Gallic acid

In Sudan, *Acacia seyal* is widespread and grows on dark cracking clay soils in east, central Sudan and northerly boundaries of Southern Sudan. The plants leaves, young shoots and pods are good fodder for animals including its tanning potential, though also produces gum but of inferior quality to *Acacia senegal*. The wood obtained from *Acacia seyal* is considered as ideal for fuel wood and charcoal production. In addition, *Acacia seyal* wood apart from being a tannin has medicinal value associated with remedial effect to rheumatism, as an insect repellent, hides and skins preservation- and also imports the skin with a nice colour and odour. In some instance, *Acacia nilotica* and *Acacia seyal* can



be found mixed with *Faidherbia albida* provide fuel in Sudan [Zeinab,1996]. The bark is reported to contain as much as 24.8% tannin content related to the main trunk as different plants have various tannin content within their leaves, pods and roots. *Acacia seyal* (Talih) is a member of the Mimosaceae family(Zeinab,1996).

Currently, leather tanning is dominated by the use of chromium (III) salts, because it gives leather unmatched hydrothermal stability and excellent organoleptic properties [Luo et al., 2011]. However, the continued reliance of chrome tanning has some negative attributes, posing serious environmental and occupational challenges within the leather industry (Mwinyihija, 2010). As a limited resource, chromium (VI) is a well-known carcinogen, but chromium (III) is considered as non-toxic (Madhan et al., 2003). Mwinyihija, (2010, 2012) reports that chromium (III) is in the leather matrix and in the environment (terrestrial, aquatic and atmospheric) might be converted to chromium (VI) in some extreme conditions requiring precautionous handling of such chemicals when in use or disposal [DasGupta,2002]. Therefore, the chrome remaining in wastewater and the solid wastes may be harmful to the environment. The disposal of these wastes brings many difficulties for the leather industries in complying with the emerging regulations (Covington,1996). In fact, some countries have restricted the use of chrome-tanned leather for certain purposes (Li et al., 2011).

However, to justify effective alternative for chromium, the choice of the tanning agent must be; abundant in nature, easily obtained, cost effective, environmental-friendly approved efficacy and should offer a competitive performance to that of chrome-tanned leather. In addition, it must be both easy and safe to use (Tate,1989). Three-dimensional interweaving of collagen fibre bundles is responsible for its characteristic mechanical properties which are important characteristics of sheep nappa leathers and influence their end use and comfort. Garment making for clothing purpose from leather involves

techniques that are similar to those used from woven fabrics. However, leather differs from textiles primarily because of the nature of the interwoven three dimensional (i.e. triple helix) collagen networks. There are numerous pores both in the fibrous network and between collagen molecules, which imparts leathers with good air/vapour permeability (Thanikaivelan et al., 2006). Since the *Acacia seyal* (Talih) extract obtained from plant material contains mixture of several compounds with varied molecular weight including polyphenols, an attempt has been made in this study to utilize them for the retanning of wet blue leathers to produce nappa upper leather.

## **Materials and Methods:**

### **Materials**

Conventionally processed wet blue sheepskins were taken for the re-tanning trials. *Acacia seyal* (Talih) barks were sourced from Alfula area, Sudan. Chemicals used for post tanning were of commercial grade.

### **Aqueous Extraction of *Acacia seyal* (Talih) barks**

The required amount of ground *Acacia seyal* (Talih) barks were soaked in water (1:10 w/v) at temperature above 80°C in water bath for an hour, filtered through the piece of cotton cloth and then concentrated to certain volume and used in re-tanning.

### **Retanning Trials**

The retanning experiments were carried out on conventionally processed wet blue sheep skins using *Acacia seyal* (Talih) bark extract. The retanning trials were carried out using wattle as a matched pair control as a comparison for the experimental leathers. The post tanning process mentioned in Table 1 is followed for both experimental and control leathers.

### **Determination of shrinkage temperature**

The shrinkage temperature of both control and experimental leathers were determined using the Theis shrinkage tester [McLaughlin,1945]. A 2cm



sample, cut out from the leather was clamped between the jaws of the clamp, which in turn was immersed in a solution of glycerol: water mixture (3:1). The solution was stirred using mechanical stirrer attached with the shrinkage tester. The temperature of the solution was gradually increased and the temperature at which the sample shrinks was noted. Triplicates were carried out for each sample and the average values are reported.

#### **Visual assessment of the crust leather**

Experimental and control crust leathers were

assessed for softness, fullness, grain smoothness, grain tightness (break), general appearance and dye uniformity by hand and visual examination. Three experienced tanners rated the leathers on a scale of 0-10 points for each functional property, where higher points indicate better property. The tanners have also evaluated the dyeing characteristics viz., uniformity of dye, shade intensity and differential dyeing for both experimental and control crust leathers.

**Table 1: Formulation of Post-tanning process for making upper crusts**

Raw material: Shaved wet blue sheep skins of thickness ~1.0 mm

% chemicals for post tanning process is based on shaved weight

| Process        | %    | Product                                      | Duration (min) | Remarks   |
|----------------|------|--|----------------|---|
| Washing        | 200  | Water  | 10             | Drain   |
| Neutralization | 100  | Water  |                |   |
|                | 1    | Sodium formate                               |                |   |
|                | 0.75 | Sodium bicarbonate                           | 3* 15          | pH 5-5.5  |
| Retanning      | 20   | Talih (Experimental)/<br>Wattle (Control)    | 1 hour         |   |
| Fatliquoring   | 5    | Lipoderm liquor SAF<br>(Synthetic fatliquor) | 45 min         |   |
| Dyeing         | 3    | Acid brown dye                               | 45 min         | Penetration of<br>dye was checked   |
| Fatliquoring   | 5    | Lipoderm liquor SAF<br>(Synthetic fatliquor) | 45 min         |   |
| Fixing         | 1.5  | Formic acid                                  | 3* 10 +30 min  | pH 3.5  |
| Washing        | 200  | Water  | 10 min         | Leathers were piled over night;<br>Next day set, hooked to dry,<br>staked, trimmed and buffed |

#### **Physical testing**

Samples for various physical tests from experimental and control crust leathers were obtained as per IULTCS methods [IUP2,2000]. Specimens were conditioned at  $20 \pm 2$  °C and  $65 \pm 2$  % R.H over a period of 48 hrs. Physical properties such as tensile strength, percentage elongation at break,

[IUP6,2000] grain crack strength [SLP 9,1996] and tear strength [IUP8, 2000] were measured as per standard procedures. Each value reported is an average of four (2 along the backbone, 2 across the back bone) samples.

#### **Chemical Analysis**

The chemical analysis of the leathers viz. for %

moisture, total ash content, % oils and fats, % water soluble, and % insoluble ash were carried out for control and experimental leathers as per standard procedures [Official Methods of Analysis, 1965]. Triplicates were carried out for each sample and the average values are reported.

## Results and discussions

### Shrinkage temperature

Shrinkage temperature (referred to as  $T_s$ ) is one of the most important parameters in characterizing the thermal stability of leather. It is the temperature at which the leather sample starts to shrink in water or other heating medium. Rapid and accurate determination of  $T_s$  is of great significance for the industrial leather production process as well as professionals in-depth research. As illustrated in Table 2, *Acacia pycnantha* (control) showed  $113 \pm 3$  shrinkage temperature  $T_s(^{\circ}\text{C})$  and *Acacia Seyal* (experimental) showed  $110 \pm 2$   $T_s(^{\circ}\text{C})$ . The high result of shrinkage temperature of *Acacia Seyal*  $110 \pm 2$   $T_s(^{\circ}\text{C})$  may indicate that it can be used as alternative materials in retanning to produce upper leather. This agreed with the standard of Bureau of Indian Standard (1964) which noted that, to produce wet blue leathers (common) the shrinkage temperature should be  $109 \pm 2^{\circ}\text{C}$ .

**Table 2:** Shrinkage temperature of crust leathers retanned with *Acacia seyal* (Talih) and *Acacia pycnantha* (Wattle)

| Sample               | Shrinkage temperature, $T_s$<br>( $^{\circ}\text{C}$ ) |
|----------------------|--|
| Wattle (Control)     | $113 \pm 3$  |
| Talih (Experimental) | $110 \pm 2$  |

**Note-** Shrinkage temperature of wet blue leathers were  $109 \pm 2^{\circ}\text{C}$

### Organoleptic properties of (Talih) *Acacia Seyal* retanned leathers

According to Table 3 below the study found that, for *Acacia Pycnantha* (Wattle) the fullness, Grain tightness, Grain smoothness, softness and General

appearance were  $7.40 \pm 1$ ,  $6.80 \pm 0.3$ ,  $7.60 \pm 0.4$ ,  $7.80 \pm 0.2$  and  $7.80 \pm 0.4$  respectively and for *Acacia seyal* (Talih) they were  $6.20 \pm 1$ ,  $7.50 \pm 0.4$ ,  $7.00 \pm 0.4$ ,  $7.50 \pm 0.2$ , and  $8.50 \pm 0.5$  respectively. The high result of *Acacia Seyal* in Grain tightness ( $7.50 \pm 0.4$ ) and General appearance ( $8.50 \pm 0.5$ ) may indicate that, *Acacia Seyal* is better than *Acacia pycnantha* (Wattle) in these parameters, So for producing upper leathers it is recommended to use *Acacia seyal* (Talih) because these properties are required especially in upper leathers. These agreed with Tuck (1981) who stated that, Grain tightness and General appearance are the most important properties for upper leathers.

**Table 3:** Organoleptic properties of crust leathers retanned with *Acacia seyal* (Talih) and *Acacia pycnantha* (Wattle)

| Property           | Talih<br>(Experimental) | Wattle<br>(Control) |
|--------------------|-------------------------|---------------------|
| Fullness           | $6.20 \pm 1$            | $7.40 \pm 1$        |
| Grain tightness    | $7.50 \pm 0.4$          | $6.80 \pm 0.3$      |
| Grain smoothness   | $7.00 \pm 0.4$          | $7.60 \pm 0.4$      |
| Softness           | $7.50 \pm 0.2$          | $7.80 \pm 0.2$      |
| General appearance | $8.50 \pm 0.5$          | $7.80 \pm 0.4$      |

### Dyeing Characteristics of *Acacia seyal* (Talih) Retanned Leathers

According to Table 4 below the study observed that, for *Acacia Pycnantha* (Wattle) uniformity of dye, Shade intensity and differential dyeing were good, good and Nil respectively, Where for *Acacia seyal* (Talih) they were very good, very good and Nil respectively. The high result of Uniformity (V.good) and Shade intensity (V.good) for *Acacia seyal* (Talih) may indicate that *Acacia seyal* (Talih) is better than *Acacia pycnantha* in dyeing characteristics So, it is useful in producing upper leathers. This agreed with (Tuck, 1981) who mentioned that Uniformity of dye, Shade intensity and differential dyeing are important for making upper leathers.

**Table 4: Visual evaluation of the dyeing characteristics  
of crust leathers retanned with *Acacia seyal*  
(Talih) and *Acacia Pycnantha* (Wattle)**

| Property            | Talih<br>(Experimental) | Wattle<br>(Control) |
|---------------------|-------------------------|---------------------|
| Uniformity of dye   | V.Good                  | Good                |
| Shade intensity     | V.good                  | Good                |
| Differential Dyeing | Nil                     | Nil                 |

### **Physical strength characteristics of *Acacia seyal* (Talih) retanned leathers**

The physical strength measurements of matched pair *Acacia seyal* (Talih) retanned experimental and *Acacia Pycnantha* (Wattle) retanned control leathers are given in Table 5. The physical strength measurements viz., tensile strength, elongation, tear strength, load at grain crack and distension at grain

has been found to be comparable. The strength values of *Acacia seyal* (Talih) retanned leathers have been found to meet the BIS standards(1964) for chrome retanned leathers.

As presented in Table 5 below the study shows that, for *Acacia Pycnantha* (Wattle) Tensile strength, Elongation at break , Tear strength, Load at grain crack and Distention at grain crack were  $251 \pm 20.8$ ,  $64.48 \pm 3.80$ ,  $42.43 \pm 3.56$ ,  $22 \pm 4$  and  $9.46 \pm 0.42$  respectively; where for *Acacia Seyal* they were  $253.15 \pm 16.7$ ,  $65.16 \pm 9.42$ ,  $41.92 \pm 7.56$ ,  $23 \pm 5$  and  $10.22 \pm 0.74$  in that order. The high result of Tensile strength ( $253.15 \pm 16.7$ ) and Load at grain crack ( $23 \pm 5$ ) for *Acacia seyal* (Talih) may indicate that *Acacia seyal* (Talih) is better than *Acacia Pycnantha* (Wattle) in the Physical strength characteristics. So, it is useful in producing upper leathers. This agreed with BIS standards (1964). It was mentioned that, Tensile strength, Tear strength, Load at grain crack and Distention at grain crack are important for making upper leathers.

**Table 5: Physical strength characteristics of crust leather retanned using *Acacia seyal* (Talih) (Exp) and *Acacia Pycnantha* (Wattle)**

| Property                               | Talih             | Wattle           | BIS norms* |
|--|-------------------|------------------|------------|
| Tensile strength (Kg/cm <sup>2</sup> ) | $253.15 \pm 16.7$ | $251 \pm 20.8$   | 250        |
| Elongation at break (%)                | $65.16 \pm 9.42$  | $64.48 \pm 3.80$ | 60-70      |
| Tear strength (Kg/cm thickness)        | $41.92 \pm 7.56$  | $42.43 \pm 3.56$ | 30         |
| Load at grain crack (kg)               | $23 \pm 5$        | $22 \pm 4$       | 20         |
| Distention at grain crack (mm)         | $10.22 \pm 0.74$  | $9.46 \pm 0.42$  | Min 7      |

Bureau of Indian standards (BIS) specification for chrome retanned upper leathers

### **Chemical Analysis of the crust leather**

Table 6 below illustrate comparative assessment between *Acacia Pycnantha* (Wattle) and *Acacia seyal* (Talih) with respect to Moisture %, Total ash content %, Fats and oils %, Water soluble matter % and Insoluble ash %. As can be seen from the

figures in the table *Acacia seyal* (Talih) is better than *Acacia pycnantha* in three (Total ash content %, Fats and oils % and Insoluble ash %) of the 5 Chemical Analysis parameters used.



**Table 6: Chemical analysis of crust leather of experimental and control**

| Parameter              | Talih (experimental) | Wattle (control) |
|------------------------|----------------------|------------------|
| Moisture %             | 8                    | 10               |
| Total ash content %    | 4.2                  | 3.7              |
| Fats and oils %        | 6.20                 | 6                |
| Water soluble matter % | 5.8                  | 6.2              |
| Insoluble ash %        | 1.60                 | 1.45             |

### Conclusion:

From the study it can be concluded that, *Acacia seyal* (Talih) (naturalize material) can be used to produce upper leathers as an alternative materials so, it can replace *Acacia Pycnantha* (Wattle) (exotic materials) especially, in retanning to produce upper leathers. *Acacia seyal* (Talih) in retanning process also gave very good results with respect to uniformity of dye and shade intensity. However, softness and strength properties were weaker than that of *Acacia Pycnantha* (Wattle) that could be solved by using fatliquoring material. As a conclusive remark the leather retanning with *Acacia seyal* (Talih) is commendable to that of *Acacia Pycnantha* when its readily availability is considered on top of its chemical quality.

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